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# Center for Advanced Computation

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

URBANA, ILLINOIS 61801

CAC Document No. 176

Research in  
Network Data Management and  
Resource Sharing

MANAGEMENT PLAN

P. A. Alsberg, Principal Investigator

September 1975

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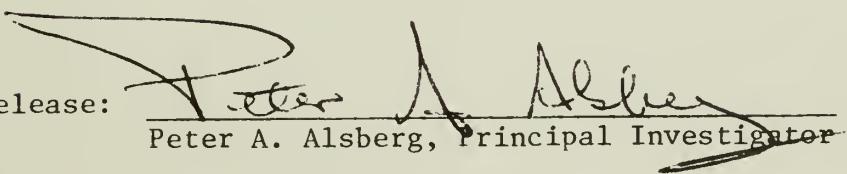
Prepared for the  
Joint Technical Support Activity  
of the  
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under contract  
DCA100-75-C-0021

Center for Advanced Computation  
University of Illinois at Urbana-Champaign  
Urbana, Illinois 61801

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Approved for release:

  
Peter A. Alsberg, Principal Investigator



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## Introduction

This report describes the management plan of the Center for Advanced Computation of the University of Illinois at Urbana-Champaign to implement contract DCA100-75-C-0021 and to effect the timely delivery of the reports specified in the contract statement of work.

This report is organized in five sections:

Deliverables,

Project Organization,

Management Reports,

Technical Management Plan, and

Government Furnished Support.



## Deliverables

The statement of work specifies thirteen deliverables with scheduled delivery dates. These deliverables will be submitted to JTSA on or before the dates indicated in Table 1. In addition, Technical Notes will be produced and delivered to JTSA whenever the state of the work warrants such technology transfer. As indicated in Table 1, the reports with delivery dates are of two types. The Technical Reports will be comprehensive documents on the topic. They will describe in some detail the state of the art and our research results to date. The Technology Reports will in general be less comprehensive documents. They will describe technical progress beyond the work reported in the corresponding Technical Reports. If the technology discussed is sufficiently well developed and if problem solutions exploiting that technology are immediately needed, then the Technology Report will address specific problems in the role of a functional specification.



Type	Title	Due Date
Management Plan		22 Sep 75
Technical Notes		As Developed
Technical Reports	Synchronization	1 Mar 76
	Deadlock	1 Mar 76
	Name-Space Management	31 May 76
	Multi-Copy Management and Backup	31 May 76
	Network File Allocation	2 Aug 76
	Data Clustering	30 Sep 76
	Experimental Management System for Distributed Data Bases	30 Sep 76
Technology Reports	Synchronization	7 Jun 76
	Deadlock	7 Jun 76
	Name-Space Management	30 Aug 76
	Multi-Copy Management and Backup	30 Aug 76
	Network File Allocation	30 Sep 76

Table 1

Deliverables



## Project Organization

The project is organized into two technical teams and a clerical support activity. Each group reports to the principal investigator, Professor Alsberg.

The two technical teams are staffed by a total of six professional researchers and three graduate research assistants. The team leaders are Professors Belford and McCauley.

Professor Belford's team will be responsible for providing analyses and theoretical evaluations of the data management and network technology which is being studied and developed in the research effort. An early phase of their work will consist of the construction of basic mathematical models (equations for cost, availability, and response time) to be used in these analyses.

Professor McCauley's team will be responsible for the design and implementation of an experimental management system for distributed data bases. They will then use this system to carry out experimentation on and testing of the data management and network technology which is being developed.

The modeling and experimental-system teams will cooperate closely on all of the research tasks to be carried out under this contract. The necessary close interaction between the two teams in solving the problems of distributed data management is pictured in Figure 1.

For management purposes, however, the primary responsibility for each research task and its associated deliverables has been assigned to a single team leader. The assignments made are as follows:



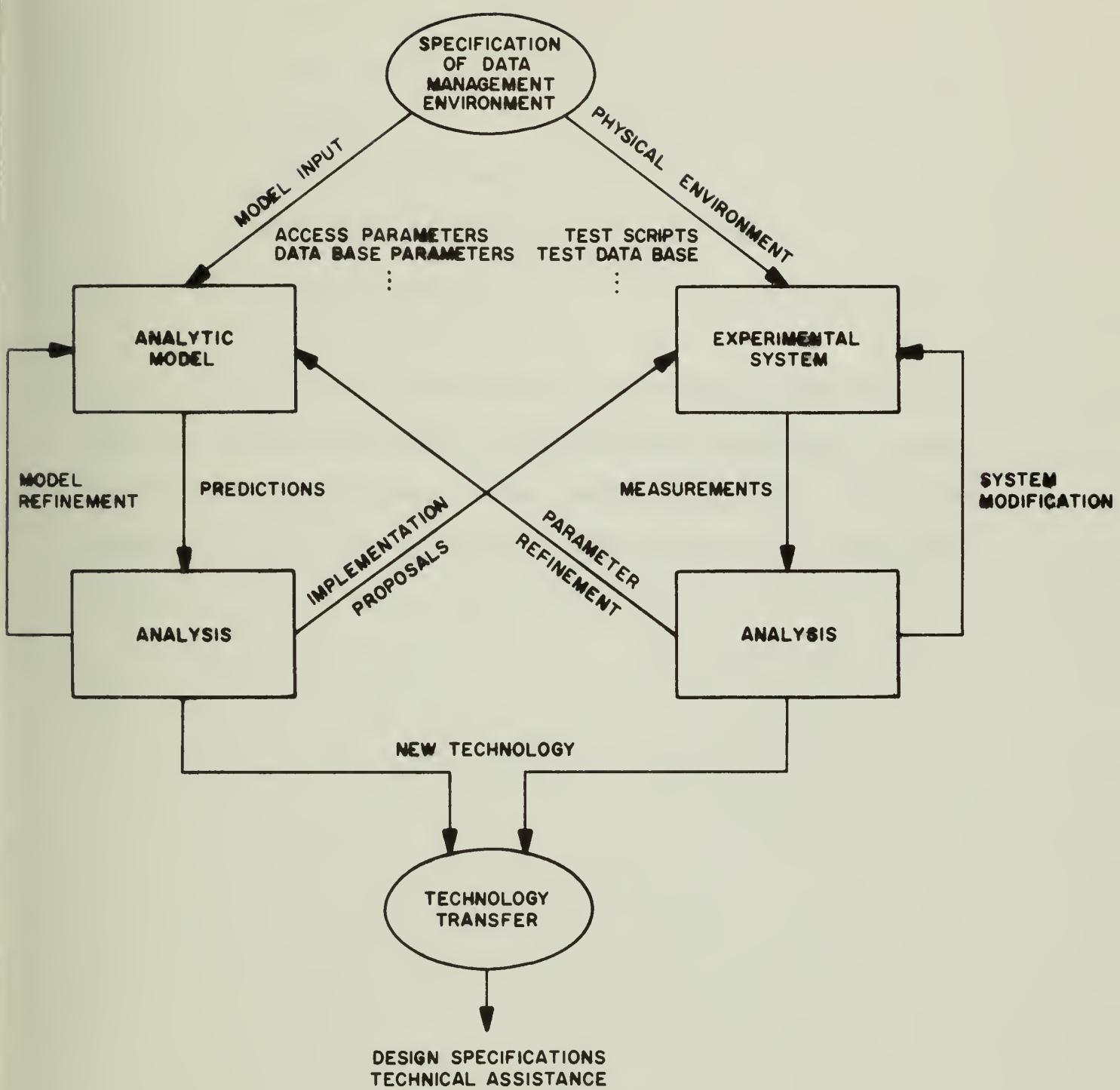


FIGURE 1  
COUPLING AMONG THE RESEARCH PROGRAM COMPONENTS



Professor Belford:

1. Deadlock,
2. File Allocation, and
3. Data Clustering.

Professor McCauley:

1. Name-space Management,
2. Multi-copy Management and Backup, and
3. Synchronization.

The technical assistance and technology-transfer tasks will be under the general supervision of the principal investigator. Project personnel will be assigned to these tasks as appropriate. The principal investigator will also have direct responsibility for the management reports.



## Management Reports

### Monthly status reports

Monthly status reports will be transmitted to JTSA 10 days after the completion of each month's work. The monthly status report will be broken into 3 major sections

1. a description of the previous month's activities,
2. a description of the schedule situation, and
3. a description of deliverable refinements and modifications.

Previous month's activities This section of the monthly status report will include

1. a narrative description of the work performed in the previous month,
2. a list of items delivered to JTSA in the previous month,
3. a list of problems encountered during the previous month (including a description of each problem and recommended solutions to each problem), and
4. a summary of manpower expended in the previous month.

Schedule The schedule section shall include a description of the status of the current schedule, a statement of its current validity and an identification of potential schedule problems. If the current schedule is invalid or if there is technical or political advantage to be gained by modifying the schedule, then a section shall be included which proposes schedule modifications. For each proposed schedule modification, the reasons for the modification, the specifics of the modification, and an assessment of the impact of the modification on resource consumption, schedule, and deliverables will be presented.



### Progress reviews

Progress reviews will be held quarterly and scheduled as mutually agreed on by the CAC and JTSA. Each progress review will be an oral briefing of JTSA personnel by the contractor. A written outline of the briefing and necessary support documents will be provided by CAC.

Progress reviews will provide an opportunity to discuss topics such as

1. project management including resource consumption and schedule,
2. technical topics including new problem areas exposed and potential solutions discovered, and
3. tutorial descriptions of distributed data management and resource sharing problems and presentations of the insights gained relative to these problems.



## Technical Management Plan

### Task organization

A separate major task has been created for each of the six research areas addressed under the contract. These areas are:

1. synchronization,
2. deadlock,
3. file allocation,
4. data clustering,
5. name-space management, and
6. multi-copy management and backup.

A seventh task, constructed to provide the experimental support for the research work is:

7. the design and implementation of an experimental management system for distributed data bases.

The six research tasks themselves are not amenable to a priori subdivision, in the sense that the problems to be solved in each area are not separable (and certainly their solutions can not be rigidly scheduled). However, production of the technical reports on results to date and of the summarizing technology reports are scheduled milestones.

The development of mathematical models forms a set of subtasks organized in large part under the multi-copy management task. Thus the development of cost, response-time, and availability models are subtasks necessary to the analysis and evaluation of alternative multi-copy management and backup strategies. Once the basic models are developed, further subtasks carried out by the modeling team will include analysis and development of proposed solutions to problems in all of the research areas. The basic models will form an important tool in this analysis.



The experimental system work is subdivided into three subtasks:

1. designing
2. programming, and
3. testing.

The design subtask involves the study and development of solutions to some of the major problems in the research areas; for example, synchronization, deadlock, and multi-copy management. Hence the experimental system task can not be structured independently of the research tasks.

#### Task dependencies

The interactions between the work of the modeling team and that of the experimental-system team, and the role played by modeling and by experimentation in the research effort, have been indicated graphically in Figure 1.

In addition, dependencies exist between research areas. For example, problems of synchronization and deadlock are basic to network resource sharing. They therefore will be addressed early in the project. Failure to determine satisfactory solutions to these problems would have a serious impact on our ability to solve the problems of multi-copy management, particularly within the context of implementing a working (although experimental) distributed data management system. Name-space management similarly plays a key role in multi-copy management.

On the other hand, file allocation and data clustering are areas which may be studied more or less independently. Definitive results in these areas (as well as in the other research areas) may, however, not be forthcoming until experiments can be carried out using the experimental system. The implementation of the experimental system is a lengthy task which is not expected to be complete by the end of the



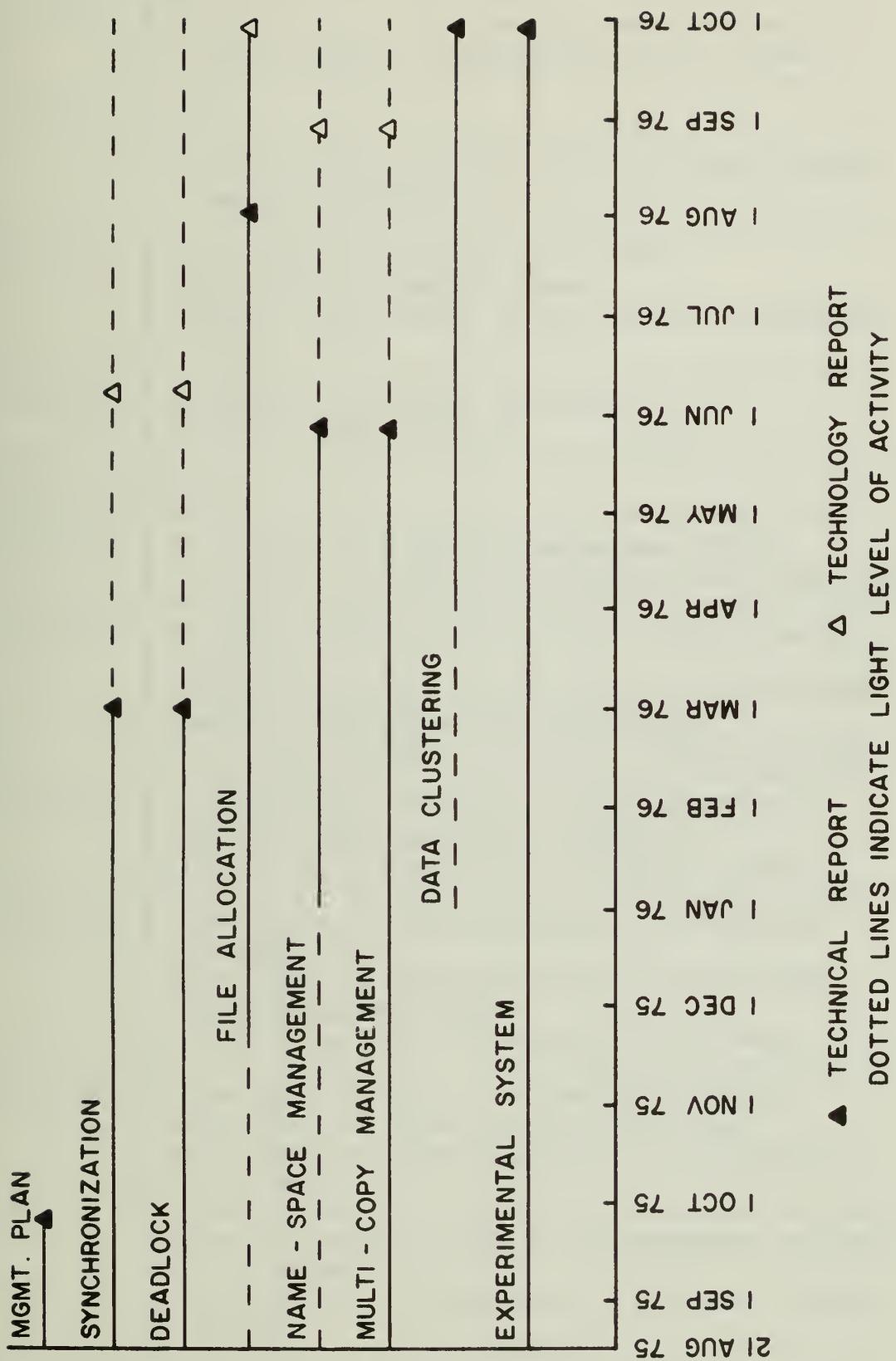
contract. Research results reported during this contract year will therefore be somewhat tentative and subject to further study and experimentation.

### Schedules

Internal schedules The team leaders are responsible for establishing detailed schedules of internal deadlines and milestones to ensure that the schedule of deliverables are met. Tentative detailed schedules have been drawn up and are available to project personnel, but they necessarily become increasingly less detailed and more subject to change as the project year progresses. For example, the experimental system design subtask has been further subdivided into several concurrent subtasks dealing with various aspects of the design. It is impossible this early in the project to gauge reliably the relative amounts of time required for the various design subtasks. In turn, the time for programming the various parts of the system can not be scheduled in detail until the design is complete.

Monthly schedules In order to assist JTSA in the evaluation of project progress, the internal project milestones have been aggregated to a set of monthly milestones. Figure 2 shows the basic scheduling of the research tasks, with due-dates of deliverables indicated. Table 2 is a month-by-month listing of the most important milestones.







Date	Milestones
1 Oct 1975	Management plan delivered
1 Nov 1975	Technical note on cost model ready for printing Detailed design of experimental system begins
1 Dec 1975	None
2 Jan 1976	Technical notes on availability and response models ready for printing
1 Feb 1976	First draft of synchronization report First draft of deadlock report Design of experimental system complete, programming begun
1 Mar 1976	Synchronization report delivered Deadlock report delivered
1 Apr 1976	None
1 May 1976	First draft of name-space management report First draft of multi-copy management and backup report
1 Jun 1976	Synchronization Technology Report written and to printers Deadlock Technology Report written and to printers Name-space management report delivered Multi-copy management and backup report delivered
1 Jul 1976	Synchronization Technology Report delivered Deadlock Technology Report delivered First draft of network file allocation report
1 Aug 1976	First draft of Technology Report on name-space management First draft of Technology Report on multi-copy management and backup Report on network file allocation delivered
1 Sep 1976	First draft of report on experimental system First draft of report on data clustering First draft of Technology Report on network file allocation Technology Report on name-space management delivered Technology Report on multi-copy management and backup delivered Begin integration and testing of basic experimental system
30 Sep 1976	Report on experimental system delivered Report on data clustering delivered Technology Report on network file allocation delivered

Table 2  
Monthly Milestones



## Government Furnished Support

### ARPA network access

The implementation of the experimental data management system is anticipated to involve extensive use of the ARPA network. Hence adequate access to the ARPA network is required. This access will be provided by maintaining the ARPA network IMP located at the Center for Advanced Computation.

### Documentation

In order that the contractor be kept up to date on how the research effort may best fulfill JTSA's needs, documentation pertinent to JTSA and WWMCCS ADP systems, especially those related to WWMCCS networking, are required. In addition, technical reports and other documents that are needed for the research work and are available from Government sources (such as the National Technical Information Service and the Government Printing Office) are required. Lists of needed documents will be submitted to the COR at irregular intervals.

















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